

A study of the mealybug genus *Planococcus* Ferris, 1950 from China, with description of a new species (Hemiptera, Coccoomorpha, Pseudococcidae)

Jiangtao Zhang¹ , Jun Deng² 

1 Key Laboratory of National Forestry and Grassland Administration on Forest Ecosystem Protection and Restoration of Poyang Lake Watershed, College of Forestry, Jiangxi Agricultural University, Nanchang, 330045, China

2 State Key Laboratory of Ecological Pest Control for Fujian and Taiwan Crops, College of Plant Protection, Fujian Agriculture and Forestry University, Fuzhou, 350002, China

Corresponding author: Jiangtao Zhang (jiang_tao_zhang@163.com)

Abstract

A study of the mealybug genus *Planococcus* Ferris, 1950 (Hemiptera, Coccoomorpha, Pseudococcidae) known from China is presented and 12 species are recognised. Of these, *Planococcus camelliae* Zhang, sp. nov. is described as new to science based on the morphology of the adult female, and *P. bambusifolii* (Takahashi, 1951) is recorded from China for the first time. Molecular analyses based on the mitochondrial gene cytochrome c oxidase subunit I (COI) of the new species and a key to species of the genus *Planococcus* in China are also given.



Academic editor: Takumasa Kondo
Received: 1 June 2023
Accepted: 30 July 2023
Published: 4 September 2023

ZooBank: <https://zoobank.org/D16FCF2E-EEFA-474B-9C78-4AAA3337ADA6>

Citation: Zhang J, Deng J (2023) A study of the mealybug genus *Planococcus* Ferris, 1950 from China, with description of a new species (Hemiptera, Coccoomorpha, Pseudococcidae). ZooKeys 1178: 77–95. <https://doi.org/10.3897/zookeys.1178.107354>

Copyright: © Jiangtao Zhang & Jun Deng. This is an open access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0).

Introduction

The genus *Planococcus* was erected by Ferris (1950) with the citrus mealybug *Dorthesia citri* Risso, 1813, as the type species, and now comprises 48 species worldwide (García Morales et al. 2016). The genus *Planococcus* includes some well-known pests, such as *Planococcus citri* (Risso, 1813) on citrus, *P. ficus* (Signoret, 1875) on grapevines, and *P. lilacinus* (Cockerell, 1905) and *P. minor* (Maskell, 1897) on cacao (Cox 1989; Williams 2004), which are often intercepted during quarantine inspections. In China, *P. lilacinus* and *P. minor* became the top two quarantine scale insects intercepted by China inspection and quarantine on imported plants and plant products from 2005 to 2014 (Gu et al. 2015).

Several authors have contributed to the study of *Planococcus* species in China. Ferris (1921) reported that *P. citri* (as *Pseudococcus citri*) from Taiwan on *Morus alba* (Moraceae). Ezzat and McConnell (1956) described a new species, *Planococcus dorsospinosus* from China, although it was treated as a junior synonym of *P. angkorensis* (Takahashi, 1942) by Williams (2004). Borchsenius (1962a) described three *Planococcus* species, *P. myrsinophilus*, *P. sinensis* and *P. siakwanensis*, from Yunnan, which the first two were regarded as junior synonyms of *P. dorsospinosus* (now *P. angkorensis*) and the last one was treated as

junior synonym of *P. kraunhiae* (Kuwana, 1902) (Cox 1989). During the same year, Borchsenius (1962b) reported another mealybug species, *Pedronia planococcoides*, from Yunnan, which was transferred to *Planococcus* as *P. planococcoides* by Tang (1992). Later, Tang and Li (1988) reported *Planococcus juniperus* Tang in Tang & Li from Inner Mongolia. Meanwhile, Tu et al. (1988) reviewed the information of the tribe Planococcini in Taiwan and recorded six *Planococcus* species: *P. angkorensis*, *P. dorsospinosus* (now *P. angkorensis*), *P. citri*, *P. kraunhiae*, *P. lilacinus* and *P. pacificus* Cox, 1981 (now *P. minor*). Subsequently, Cox (1989) provided a systematic revision of the genus *Planococcus* and reported *P. litchi* from China, and Tang (1992) reported *P. lilacinus* as *P. indicus* (Avasthi & Shafee, 1987) from Guangxi. Recently, Pan et al. (2021) reported *P. japonicus* Cox, 1989 from Yunnan and Yuan and Wei (2022) reported *P. vovae* (Nasonov, 1909) from Hebei. To date, there are 10 *Planococcus* species reported from China. Here we describe an additional new species, *P. camelliae* Zhang, sp. nov. and report a new Chinese record, *P. bambusifolii* (Takahashi, 1951).

Materials and methods

Sampling and morphological identification

Slide-mounted specimens were prepared using the methods of Borchsenius (1950), stained in acid fuchsin, and mounted in Canada balsam. Terminology follows that of Hendricks and Kosztarab (1999) and Williams (2004). Measurements were taken from six specimens. Measurements are given in micrometres (μm) except for the length and width of the body that are in millimetres (mm). Only the known host plants and distribution of each species in China are listed.

Slides of the new species are deposited at the College of Forestry, Jiangxi Agricultural University, Nanchang, China (**CFJAU**) and the Insect Collection of the Southwest Forestry University, Yunnan, China (**SWFU**).

DNA extraction, PCR, and sequencing

DNA extraction, polymerase chain reaction (PCR), and sequencing mainly follow the methods given by Zhang et al. (2018). Two mitochondrial gene cytochrome c oxidase subunit I (COI) sequences of *P. camelliae* were submitted to the NCBI database under the accession numbers OR004347 and OR004348. The sequences of the COI barcode region of *P. citri* (Risso) (KP692647), *P. kraunhiae* (Kuwana) (KP981071), *P. lilacinus* (Cockerell) (KP692654) and *P. minor* (Maskell) (KP692660) were downloaded from GenBank online. Sequences were aligned in BioEdit v. 7.1.3 using ClustalW (Hall 1999). Genetic distances within and between species were calculated using Mega X (Kumar et al. 2018) with the Kimura two-parameter (K2P) model (Kimura 1980).

Taxonomy

Genus *Planococcus* Ferris, 1950

Planococcus Ferris, 1950: 164.

Allococcus Ezzat & McConnell, 1956: 13.

Diagnosis. (adapted from Williams 2004). Body of adult female elongate oval to broadly oval. Antennae each with seven or eight segments. Legs well developed, with translucent pores on hind coxa and usually with some on hind tibia, claw without a denticle. Circulus present or absent. Ventral surface of each anal lobe with long apical seta, anal lobe bar and bar seta present. Cisanal setae either longer or shorter than anal ring setae. Anterior and posterior pairs of ostioles present. Marginal cerarii usually 18 pairs, each bearing two conical setae, or some paired flagellate setae, sometimes one or two cerarii of head, each with 3–5 setae; auxiliary setae usually absent, except for anal lobe cerarii. Trilocular pores usually evenly distributed. Oral collar tubular ducts situated on venter, always on abdomen and sometimes on head and thorax; often with indistinct rims when present on dorsum (sometimes termed modified oral collar tubular ducts). Multilocular disc pores rarely present on dorsum, always present on venter of abdomen. Body setae flagellate or short and stiff, sometimes knobbed at apex or almost lanceolate, conical. Discoidal pores present, sometimes larger than trilocular pores.

Key to adult females of *Planococcus* known from China (adapted and modified from Williams 2004; Danzig and Gavrilov-Zimin 2010)

- 1 Dorsal tubular ducts numerous, located along body margins and in middle areas of body; usually on Cupressaceae **2**
- Dorsal tubular ducts, if present, located near cerarii only, or a few in middle part of abdomen, or in small groups along body margins; usually on deciduous trees and shrubs **3**
- 2 Cerarii numbering 18 pairs (rarely 14 pairs); circulus present.....
..... ***P. vovae* (Nasonov)**
- Cerarii numbering 17 pairs; circulus absent ***P. juniperus* Tang in Tang & Li**
- 3 Some cerarii on head and thorax, each with more than 2 conical setae, or some cerarii with paired long setae, or 1 conical seta and 1 long flagellate seta..... **4**
- All cerarii on head and thorax, excepted for ocular pair (C_3), each with 2 conical setae only..... **5**
- 4 All cerarii with conical setae; dorsal setae short and stout ***P. japonicus* Cox**
- One or more cerarii containing 1 or 2 long and flagellate setae; dorsal setae long and flagellate..... ***P. lilacinus* (Cockerell)** – in part
- 5 Multilocular disc pores present on margins of abdominal segments, even if only 1 or 2 present on each segment..... **6**
- Multilocular disc pores absent from margins of abdominal segments entirely, except for an occasional pore **9**
- 6 Dorsal oral collar tubular ducts present in groups of 2–5 next to some abdominal cerarii..... ***P. kraunhiae* (Kuwana)**
- Dorsal oral collar tubular ducts, if present, located singly next to some abdominal cerarii..... **7**
- 7 Venter of head with 14–35 oral collar tubular ducts and/or thorax with total of 7–35 ducts near 8th pair of cerarii (C_8); ventral ducts on head and next to 8th pair of cerarii totalling 15–50..... ***P. citri* (Risso)** – in part
- Venter of head with 0–13 oral collar tubular ducts and thorax with 0–6 ducts near 8th pair of cerarii (C_8); ventral ducts on head and next to 8th pair of cerarii totalling 0–18..... **8**

8 Ratio of length of hind tibia + tarsus to trochanter + femur 1.10–1.13; multilocular disc pores on posterior edges of abdominal segments IV–VII forming more or less single rows..... *P. citri* (Risso) – in part

– Ratio of length of hind tibia + tarsus to trochanter + femur 1.04–1.18; multilocular disc pores on posterior edges of abdominal segments IV–VII usually present in double rows..... *P. minor* (Maskell)

9 Ventral multilocular disc pores present on abdominal segment IV 10

– Ventral multilocular disc pores absent from abdominal segment IV
..... *P. bambusifolii* (Takahashi)

10 Dorsum with conical setae present, many as large as cerarian setae..... 11

– Dorsum with flagellate or stout setae present, base of each seta narrower than cerarian setae..... 13

11 Cerarii on dorsal midline, if present, numbering fewer than 7 pairs; translucent pores absent from hind femur..... 12

– Cerarii on dorsal midline present, numbering 7 or 8 pairs; translucent pores usually present on hind femur..... *P. planococcoides* (Borchsenius)

12 Dorsal setae approx. same size as cerarian setae, mostly with flagellate tips; some dorsal setae on thorax and midline of abdomen present in conspicuous pairs
..... *P. litchi* Cox

– Dorsal setae each usually shorter than a cerarian seta, without flagellate tips; mostly single but occasionally up to 4 conspicuous pairs present.....
..... *P. angkorensis* (Takahashi)

13 Dorsal oral collar tubular ducts present; oral collar tubular present on venter but absent from beneath each postocular cerarius (C_4)
..... *P. camelliae* Zhang, sp. nov.

– Dorsal oral collar tubular ducts absent; at least 1 ventral oral collar tubular duct usually present beneath each postocular cerarius (C_4)
..... *P. lilacinus* (Cockerell) – in part

Descriptions

Planococcus angkorensis (Takahashi, 1942)

Pseudococcus angkorensis Takahashi, 1942: 10.

Planococcus dorsospinosus Ezzat & McConnell, 1956: 75.

Planococcus myrsinophilus Borchsenius, 1962a: 585.

Planococcus sinensis Borchsenius, 1962a: 586.

Planococcus angkorensis: Ali 1970: 89.

Host plants. Anacardiaceae: *Rhus* sp.; Araceae: *Colocasia esculenta*; Daphniphyllaceae: *Daphniphyllum* sp.; Euphorbiaceae: *Euphorbia* sp.; Fabaceae: *Pueraria montana* (= *P. hirsuta*); Melastomataceae: *Melastoma* sp.; Moraceae: *Ficus tinctoria* (= *F. gibbosa*), *Morus* sp.; Myrtaceae: *Psidium guajava*; Primulaceae: *Myrsine africana*; Sapindaceae: *Litchi* sp.; Scrophulariaceae: *Buddleja officinalis*; Urticaceae: *Oreocnide frutescens* (= *Boehmeria frutescens*) (Ezzat and McConnell 1956; Borchsenius 1962a; Tu et al. 1988; Cox 1989; Martin and Lau 2011).

Distribution. Hongkong, Taiwan, Yunnan (Borchsenius 1962a; Tu et al. 1988; Martin and Lau 2011).

Remarks. Good descriptions and illustrations of the adult female can be found in Ezzat and McConnell (1956), Tu et al. (1988), and Williams (2004).

***Planococcus bambusifolii* (Takahashi, 1951)**

Pseudococcus bambusifolii Takahashi, 1951: 9.

Planococcus bambusifolii: Tang 1992: 367.

Material examined. Guizhou: 2 ♀♀, Southwest Guizhou Autonomous Prefecture, Xingyi City, Maling River Canyon, on bamboo, 7.v.2017, coll. Jiang-tao Zhang & Ming Zhao.

Host plant. Poaceae: bamboo.

Distribution. Guizhou.

Remarks. This is the first record of this mealybug in China. A good description and illustration of the adult female was given by Williams (2004).

***Planococcus camelliae* Zhang, sp. nov.**

<https://zoobank.org/D1CFA1AF-A504-4CF3-ACEF-8D9C41CD00>

Figs 1–3

Material examined. Holotype: CHINA: 1 ♀ (mounted singly on a slide), Jiangxi Province, Fuzhou City, Le'an County, Jinzhu she minority Township, Pingxi Village [27°06'N, 115°56'E], on *Camellia oleifera* (Theaceae), 5.x.2019, coll. Jiang-tao Zhang (CFJAU). **Paratypes:** 4 ♀♀ (mounted on 4 slides), same data as holotype (2 CFJAU, 2 SWFU); 6 ♀♀ (mounted on 6 slides), same collection and host plant as holotype, 4.viii.2018, coll. Jiang-tao Zhang (4 CFJAU, 2 SWFU).

Other material examined. 1 ♀ (mounted on 1 slide), same data as holotype (CFJAU); 8 ♀♀ (mounted on 7 slides), same collection and host plant as holotype, 4.viii.2018, coll. Jiang-tao Zhang (CFJAU).

Description. In life body oval, covered in white mealy wax, with ~ 18 pairs of short lateral filaments around body margin, found inside ant nests or tents on *Camellia oleifera* branches and fruits (Fig. 1).

Body of adult female on microscope (Fig. 2) oval, 1.40–3.98 mm long and 0.85–2.39 mm wide. Anal lobes developed, each ventral surface with an apical seta 187–275 µm long, and a well-developed anal lobe bar. Antennae 8-segmented, each 336.5–427.5 µm long, lengths of segments: I 40–50, II 40–52.5, III 42.5–60, IV 20–40, V 22.5–44, VI 30–36.5, VII 37.5–42.5, VIII 87.5–107.5 µm. Clypeolabral shield 142.5–167.5 µm long, 112.5–137.5 µm wide. Labium 131.5–157.5 µm long, 60–75 µm wide. Legs well developed, slender; hind coxa 60–84 µm long, hind trochanter + femur 202.5–277.5 µm long, hind tibia + tarsus 241.5–327.5 µm long; claw 20–25 µm long, both tarsal digitules and claw digitules knobbed, longer than claw. Ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1: 1.11–1.19. Ratio of lengths of hind tibia to tarsus 1: 1.64–2.29. Translucent pores present on hind coxa and tibia. Circulus present, nearly square, 55–112.5 µm long and 50–71.5 µm wide, divided by an intersegmental line. Both anterior and posterior ostioles present, each lip with 7–22 trilocular pores and 1–5 setae. Anal ring 60–85 µm wide, bearing six long



Figure 1. *Planococcus camelliae* Zhang, sp. nov.: **A** an ant carton that harbours mealybugs inside **B** mealybugs found inside ant carton with tending ants.

setae, each 105–150 μm long. Cerarii numbering 18 pairs. Anal lobe cerarii (C_{18}) each bearing two conical setae, each seta 20–24 μm long, accompanied by 2–5 auxiliary setae and 15–25 trilocular pores, situated on a small slightly sclerotised area. Other cerarii, sometimes situated on small prominences, each bearing two conical setae, occasionally only with one conical seta, but ocular pairs (C_3) sometimes with three conical setae, all cerarian setae conical and with flagellate tips, accompanied by 4–10 trilocular pores. Discoidal pores smaller than the trilocular pores, sparsely but evenly distributed.

Dorsum. Setae stout, moderate length and with flagellate tips (Fig. 3), sometimes with one or two trilocular pores next to setal bases, each 20–32.5 μm long. Trilocular pores present, each 3–4 μm in diameter, evenly distributed. Oral collar tubular ducts present and without apparent rims, each 8–10 μm long, 3–4 μm wide, in small marginal groups around posterior abdominal segments, usually 1 duct adjacent to some abdominal cerarii, occasionally also present on median areas of abdominal segments. Multilocular disc pores absent.

Venter. Setae flagellate, longer seta each 75–142.5 μm long. Cisanal setae 50–70 μm long, shorter than anal ring seta. Trilocular pores similar to those on dorsum, evenly distributed. Oral collar tubular ducts of two main sizes: the small type, each 6–7 μm long, 2 μm wide, mainly distributed across middle of abdominal segments II–VII, also a few occurring on median areas of thorax and intermixed with marginal ducts; the large type, similar to those on dorsum, present in transverse rows across abdominal segments III–VII, also in marginal groups around head, thorax, and abdomen, but absent from opposite each postocular cerarius (C_4). Multilocular disc pores each 8–9 μm in diameter, around vulva, in single or double rows across posterior edges of abdominal segments VII, in single rows across posterior edges of abdominal segments IV–VI, scattered or in single rows across anterior edges of abdominal segments IV–VII or V–VII, sometimes 1–4 pores also on abdominal segment III, a few pores sometimes scattered over median areas of the thorax and head, pores entirely absent from margins of abdominal segments.

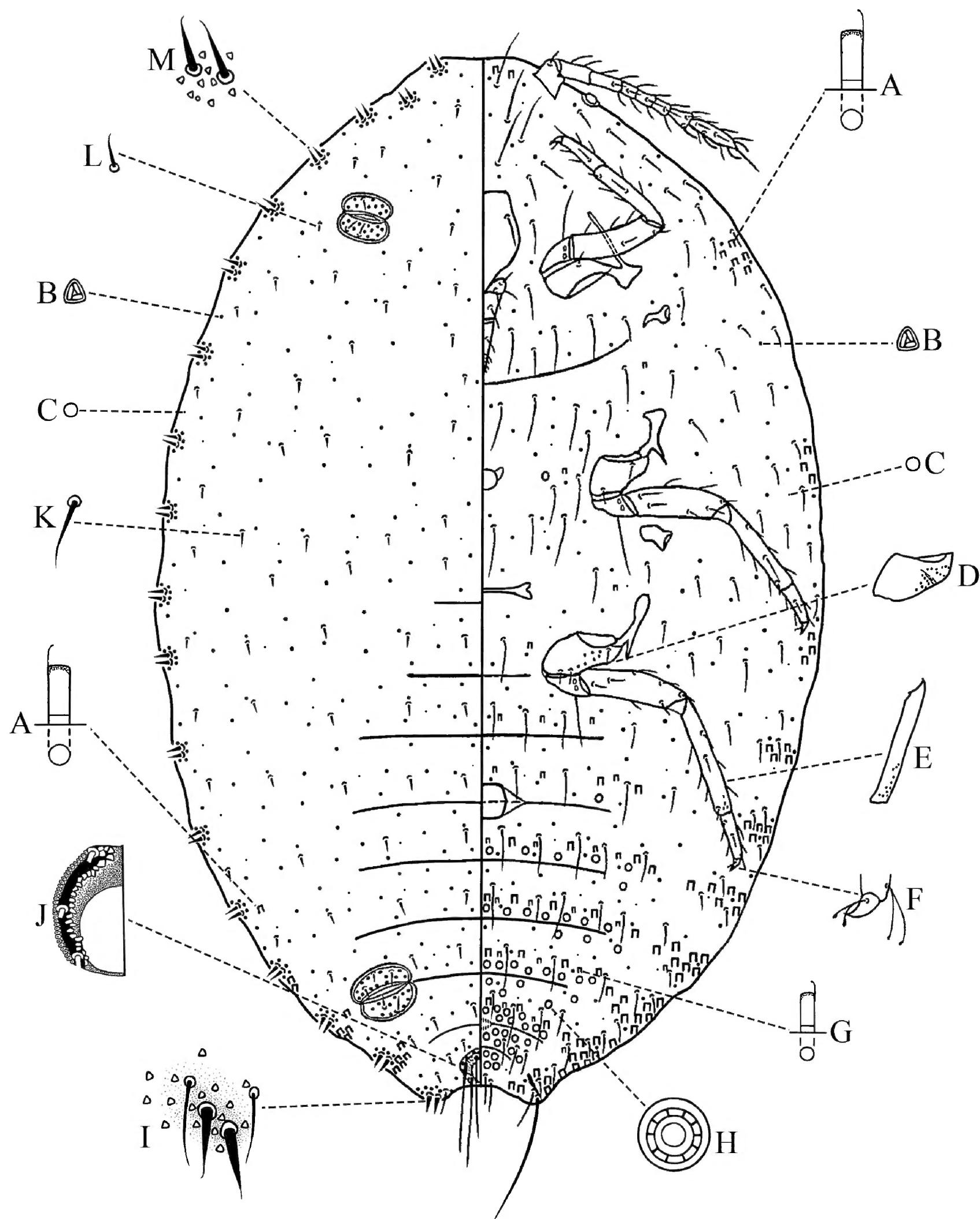


Figure 2. Adult female of *Planococcus camelliae* Zhang, sp. nov.: **A** Large oral collar tubular duct **B** trilocular pore **C** discoidal pore **D** hind coxa **E** hind tibia **F** claw **G** small oral collar tubular duct **H** multilocular disc pore **I** anal lobe cerarius (C_{18}) **J** anal ring **K** large dorsal seta **L** small dorsal seta **M** cerarius on head.

Host plant. Theaceae: *Camellia oleifera*.

Distribution. China (Jiangxi).

Remarks. *Planococcus camelliae* sp. nov. is similar to *P. kraunhiae* by having oral collar tubular ducts present on dorsum, but it differs from the latter by the following features (condition of *P. kraunhiae* given in parenthesis): (i) multilocular disc pores absent from margins of abdominal segments (present on

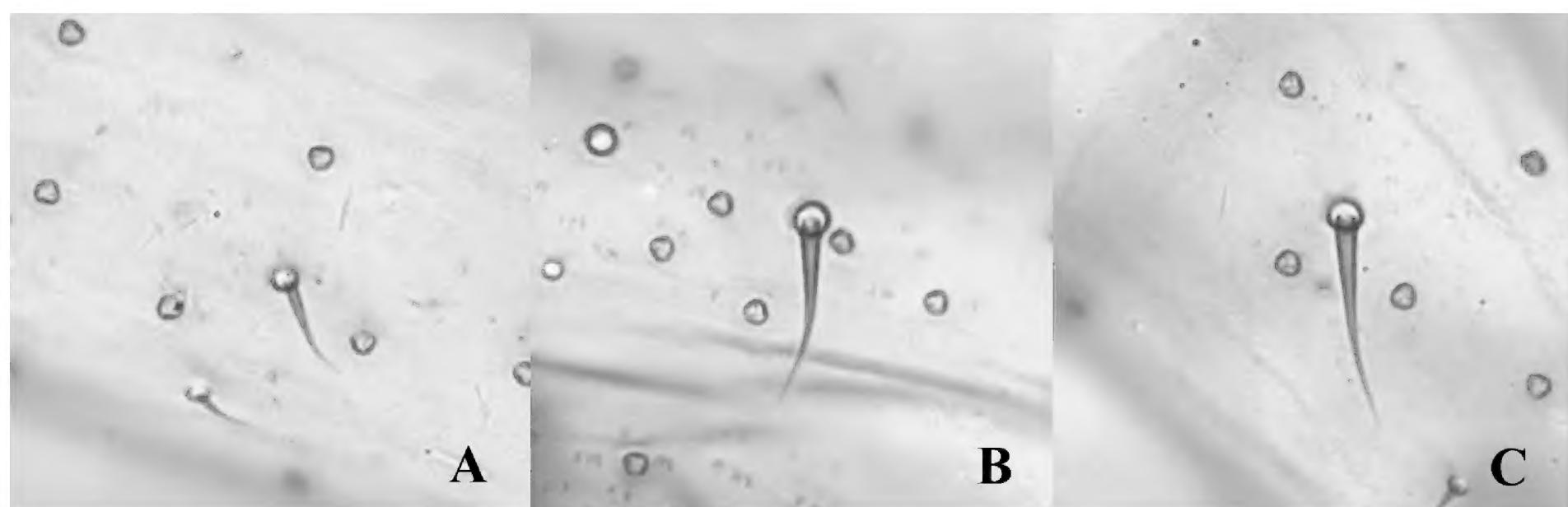


Figure 3. Dorsal setae on *Planococcus camelliae* Zhang, sp. nov.: **A** small seta **B** large seta with trilocular pore next to setal base **C** large seta without trilocular pore next to setal base.

Table 1. Pairwise genetic divergences among *Planococcus* species.

Species	GenBank code	K2P pairwise distances (%) of COI gene					
		0	0	10.62	12.21	10.08	7.51
<i>P. camelliae</i>	OR004347	0					
<i>P. camelliae</i>	OR004348	0	0				
<i>P. citri</i>	KP692647	10.62	10.62				
<i>P. kraunhiae</i>	KP981071	12.21	12.21	10.08			
<i>P. lilacinus</i>	KP692654	10.44	10.44	7.51	7.90		
<i>P. minor</i>	KP692660	11.19	11.19	1.65	9.90	6.97	

margins); (ii) single dorsal oral collar tubular ducts usually adjacent to some abdominal cerarii (in groups of 2–5 next to some abdominal cerarii); (iii) dorsal oral collar tubular ducts usually similar in size to the large ducts on venter (usually larger than those on venter). The new species also resembles the type of *P. citri* with oral collar tubular ducts present on dorsum, but it differs from the latter by the following features (condition of *P. citri* given in parenthesis): (i) multilocular disc pores absent from margins of abdominal segments (present on margins); (ii) dorsal setae stout and with flagellate tips (usually flagellate); (iii) dorsal oral collar tubular ducts usually similar in size to the large ducts on venter (if present, usually larger than those on venter).

The pairwise genetic divergences (by K2P distance) in COI among these six specimens (of five species) are listed in Table 1. The K2P distance is 0.00% within *P. camelliae*, 10.44–12.21% between *P. camelliae* and other four *Planococcus* species list. In mealybugs, the interspecific variation in COI is 11.53% (1.96–19.48%) (Wang et al. 2016), and therefore, our molecular data confirms *P. camelliae* as a distinct species.

Etymology. The species epithet is derived from the generic name of its host plant, *Camellia*.

Planococcus citri (Risso, 1813)

Dorthesia citri Risso, 1813: 416.

Coccus tuliparum Bouché, 1844: 301.

Dactylopius alaterni Signoret, 1875: 309.
Dactylopius ceratoniae Signoret, 1875: 311.
Dactylopius cyperi Signoret, 1875: 314.
Dactylopius robiniae Signoret, 1875: 322.
Lecanium phyllococcus Ashmead, 1879: 160.
Dactylopius brevispinus Targioni Tozzetti, 1881: 137.
Dactylopius destructor Comstock, 1881: 342.
Dactylopius secretus Hempel, 1900: 387.
Phenacoccus spiriferus Hempel, 1900: 389.
Pseudococcus citri coleorum Marchal, 1908: 236.
Pseudococcus citri phenacocciformis Brain, 1915: 116.
Planococcus citri: Ferris 1950: 165.
Planococcoides cubanensis Ezzat & McConnell, 1956: 53.
Planococcus citricus Ezzat & McConnell, 1956: 69.
Planococcus cucurbitae Ezzat & McConnell, 1956: 71.

Material examined. Beijing: 2 ♀♀, Changping District, Beiqijia Town, *Aloe vera*, 10.xi.2016, coll. Chao-dong Zhu; 5 ♀♀, Beijing world flower Wonderland Park (greenhouse), *Dizygotheca elegantissima*, 7.v.2009, coll. Shan-shan Wang & Wang-mu Deqing; 1 ♀, Tsinghua University (greenhouse), *Codiaeum variegatum*, 13.iii.2009, coll. Shan-shan Wang & Wang-mu Deqing; 3 ♀♀, Tsinghua University (greenhouse), *Livistona chinensis*, 12.iii.2009, coll. Shan-shan Wang & Wang-mu Deqing; 6 ♀♀, Tsinghua University (greenhouse), *Ficus elastica*, 12.iii.2009, coll. Shan-shan Wang & Wang-mu Deqing; 3 ♀♀, Tsinghua University (greenhouse), host plant unknown, 12.iii.2009, coll. Shan-shan Wang & Wang-mu Deqing; 3 ♀♀, Beijing Forestry University (greenhouse), *Ficus microcarpa*, 14.ii.2009, coll. San-an Wu; 4 ♀♀, China Agricultural University (greenhouse), *Asparagus setaceus*, 22.i.2009, coll. Shan-shan Wang; 3 ♀♀, China Agricultural University (greenhouse), *Kalanchoe blossfeldiana*, 22.i.2009, coll. Shan-shan Wang; 17 ♀♀, Beijing Botanical Garden, *Pelargonium hortorum*, 8.vii.2006, coll. San-an Wu; 3 ♀♀, Beijing Botanical Garden (greenhouse), *Codiaeum variegatum*, 21.iv.2000, coll. San-an Wu; 2 ♀♀, Beijing Botanical Garden (greenhouse), *Mussaenda esquiroillii*, 21.iv.2000, coll. San-an Wu; 5 ♀♀, Beijing Botanical Garden (greenhouse), *Neolamarckia cadamba*, 17.iv.2000, coll. San-an Wu; 4 ♀♀, Beijing Botanical Garden (greenhouse), *Combretum latifolium*, 25.iii.2000, coll. San-an Wu; 7 ♀♀, Beijing Botanical Garden (greenhouse), *Sedum* sp., 2.xi.1999, coll. San-an Wu. Fujian: 2 ♀♀, Xiamen City, near Yanwu Bridge, *Nerium indicum*, 18.v.2015, coll. Qing-song Zhou & Xu-bo Wang; 8 ♀♀, Zhangzhou City, Pinghe County, *Psidium guajava*, 22.viii.2011, coll. Ying Guo. Guangdong: 6 ♀♀, Zhanjiang City, *Annona squamosa*, 26.vii.2010, coll. Yan-biao He. Guangxi: 2 ♀♀, Baise City, Multinational Autonomous County of Longlin, Loushan Road, *Pterocarya stenoptera*, 4.v.2017, coll. Jiang-tao Zhang & Ming Zhao; 2 ♀♀, Baise City, Multinational Autonomous County of Longlin, Yingbin 2 Road, *Artocarpus heterophyllus*, 4.v.2017, coll. Jiang-tao Zhang & Ming Zhao; 2 ♀♀, Baise City, Jingxi City, Chengzhong Road, host plant unknown, 28.iv.2017, coll. Jiang-tao Zhang & Ming Zhao; 2 ♀♀, Wuzhou City, Cangwu County, *Bischofia javanica*, 5.v.2015, coll. Qing-song Zhou & Xu-bo Wang; 2 ♀♀, Baise City, host plant unknown, coll. Jun Deng, Xu-bo Wang & Xu Zhang. Hainan: 2 ♀♀, Sanya City, *Psidium guajava*, 10.xii.2011, coll. Hong-wei Luo. Hebei: 14 ♀♀, Cangzhou City, Renqiu City, *Coleus blumei*, 29.ix.2016,

coll. Ming-guo Dai. Shanghai: 4 ♀♀, Shanghai Chen Shan Botanical Garden, *Jatropha curcas*, 9.xii.2010, coll. Ying Xu. Sichuan: 4 ♀♀, Neijiang City, Haozikou Road, *Bischofia javanica*, 19.vii.2014, coll. Jiang-tao Zhang & Xu-bo Wang; 8 ♀♀, Neijiang City, Haozikou Road, *Erythrina variegata*, 19.vii.2014, coll. Jiang-tao Zhang & Xu-bo Wang. Xinjiang: 14 ♀♀, Hotan Prefecture (greenhouse), Yutian County, *Nerium oleander*, 12.iii.2010, coll. Ze-zi Ai. Yunnan: 2 ♀♀, Ruili City, Nanmao Lake Park, *Calliandra haematocephala*, 22.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 1 ♀, Puer City, Lancang Lahu Autonomous County, Menglang Street, *Bischofia javanica*, 17.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Xishuangbanna Tropical Botanical Garden, *Opuntia dillenii*, 23.x.2013, coll. Fang Yu, Jun Deng, Qing-song Zhou & Xu-bo Wang; 3 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Mengla County, Menglun Town, *Lablab purpureus*, 23.x.2013, coll. Fang Yu, Jun Deng, Qing-song Zhou & Xu-bo Wang; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Mengla County, Menglun Town, *Canna indica* var. *flava*, 23.x.2013, coll. Fang Yu, Jun Deng, Qing-song Zhou & Xu-bo Wang; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Xishuangbanna Tropical Botanical Garden, *Lucuma nervosa*, 22.x.2013, coll. Fang Yu, Jun Deng, Qing-song Zhou & Xu-bo Wang.

Host plants. Acanthaceae: *Pachystachys lutea*; Amaryllidaceae: *Hippeastrum equestre*; Anacardiaceae: *Mangifera indica*; Annonaceae: *Annona squamosa*; Apocynaceae: *Adenium obesum*, *Nerium oleander* (= *N. indicum*); Araliaceae: *Dizygotheca elegantissima*, *Tetrapanax papyriferus*; Arecaceae: *Areca catechu*, *Livistona chinensis*; Asparagaceae: *Asparagus setaceus*; Asphodelaceae: *Aloe vera*; Asteraceae: *Bidens chilensis*, *Blumea balsamifera*, *Erigeron canadensis*; Cactaceae: *Opuntia dillenii*; Cannaceae: *Canna coccinea*, *C. flaccida*, *C. indica*, *C. indica* var. *flava*; Combretaceae: *Combretum latifolium*; Convolvulaceae: *Ipomoea batatas*; Crassulaceae: *Bryophyllum pinnatum*, *Kalanchoe blossfeldiana*, *Sedum* sp.; Cucurbitaceae: *Cucurbita moschata*, *Luffa cylindrica*; Cyclanthaceae: *Carludovica palmata*; Dioscoreaceae: *Dioscorea* sp.; Ebenaceae: *Diospyros kaki*, *D. philippensis*; Euphorbiaceae: *Codiaeum variegatum*, *Euphorbia pulcherrima*, *Jatropha curcas*, *Macaranga tanarius*, *Mallotus japonicus*; Fabaceae: *Acacia confusa*, *Bauhinia purpurea*, *Calliandra haematocephala*, *Desmodium intortum*, *Erythrina variegata*, *Lablab purpureus*, *Lespedeza* sp., *Sophora tomentosa*; Geraniaceae: *Pelargonium hortorum*; Juglandaceae: *Pterocarya stenoptera*; Lamiaceae: *Ajuga bracteosa*, *Clerodendrum trichotomum*, *Coleus blumei*, *Tectona grandis*; Lauraceae: *Persea gratissima*; Malpighiaceae: *Malpighia glabra*; Malvaceae: *Theobroma cacao*; Marantaceae: *Calathea tubispatha*; Moraceae: *Artocarpus altilis* (= *A. incisus*), *A. heterophyllus*, *Ficus elastica*, *F. formosana*, *F. microcarpa*, *Morus alba*; Musaceae: *Musa sapientum*; Myrtaceae: *Psidium guajava*; Orchidaceae: *Thrixspermum formosanum*; Pandanaceae: *Pandanus amaryllifolius*; Passifloraceae: *Passiflora edulis*; Phyllanthaceae: *Bischofia javanica*; Rhizophoraceae: *Kandelia rheedii*; Rosaceae: *Pyrus malus*; Rubiaceae: *Coffea arabica*, *Gardenia jasminoides*, *Ixora chinensis*, *Mussaenda esquirolii*, *Neolamarckia cadamba*; Rutaceae: *Citrus* sp., *C. limon*, *C. maxima*, *C. medica* var. *sarcodactylis*, *Clausena lansium*; Sapindaceae: *Dimocarpus longan*; Sapotaceae: *Lucuma nervosa*; Solanaceae: *Solanum aculeatissimum*, *S. diphylum*, *S. pseudocapsicum*, *S. tuberosum*; Strebliziaceae: *Strelitzia reginae*; Theaceae: *Camellia sinensis*; Verbenaceae: *Lantana camara*, *Verbena* sp. (Martin and Lau 2011; Tsai 2011; Guo et al. 2014; Wang et al. 2016; Wang et al. 2018; Bai et al. 2020).

Distribution. *Planococcus citri* has a wide distribution in China and it is often difficult to separate from *P. minor* because of the variation in numbers of ventral oral collar tubular ducts. Material examined here is from Beijing, Fujian, Guangdong, Guangxi, Hainan, Hebei, Shanghai, Sichuan, Xinjiang, Yunnan.

Remarks. Good descriptions and illustrations of the adult female can be found in Tu et al. (1988), Cox (1989), and Williams (2004).

***Planococcus japonicus* Cox, 1989**

Planococcus japonicus Cox, 1989: 37.

Material examined. Yunnan: 1 ♀, Dali Bai Autonomous Prefecture, Xiangyun Country, *Osmanthus fragrans*, 10.vii.2021, coll. Hang Chen & Jiang-tao Zhang; 6 ♀♀, Qujing City, Malong District, *Celtis* sp., 7.vii.2019, coll. Jiang-tao Zhang, Kun Hang & Yan Li; 3 ♀♀, Kunming City, Kunming Yunnan West Mountain, *Osmanthus fragrans*, 6.vi.2014, coll. Fu-zhong Wu.

Host plants. Cannabaceae: *Celtis* sp.; Oleaceae: *Osmanthus fragrans* (Pan et al. 2021).

Distribution. Yunnan.

Remarks. Good descriptions and illustrations of the adult female can be found in Cox (1989), Williams (2004), and Pan et al. (2021).

***Planococcus juniperus* Tang in Tang & Li, 1988**

Planococcus juniperus Tang in Tang & Li, 1988: 42.

Crisicoccus juniperus: Tang 1992: 352.

Host plant. Cupressaceae: *Juniperus rigida* (Tang and Li 1988).

Distribution. Inner Mongolia (Tang and Li 1988).

Remarks. *Planococcus juniperus* was transferred to *Crisicoccus* as *C. juniperus* by Tang (1992), but it was subsequently treated as a junior synonym of *P. vovae* (Nasonov) by Danzig and Gavrilov-Zimin (2010). Recently, this mealybug was revived as a valid species by Wu et al. (2023) based on morphological and molecular studies. A good description and illustration of the adult female was given by Tang and Li (1988).

***Planococcus kraunhiae* (Kuwana, 1902)**

Dactylopius kraunhiae Kuwana, 1902: 55.

Planococcus kraunhiae: Ferris 1950: 168.

Planococcus siakwanensis Borchsenius, 1962a: 586.

Material examined. Fujian: 2 ♀♀, Nanping City, Jian'ou City, *Broussonetia papyrifera*, 5.viii.2019, coll. Jiang-tao Zhang & Kun Huang. Hubei: 11 ♀♀, Jingzhou City, *Broussonetia papyrifera*, 8.x.2003, coll. San-an Wu. Sichuan: 2 ♀♀, Bazhong City, Pingchang County, Xihuan Street, *Ficus concinna*, 7.viii.2014, coll.

Jiang-tao Zhang & Xu-bo Wang; 9 ♀♀, Nanchong City, Yingshan Country, Waixi Street, *Girardinia diversifolia*, 3.viii.2014, coll. Jiang-tao Zhang & Xu-bo Wang; 7 ♀♀, Langzhong City, *Broussonetia papyrifera*, 1.viii.2014, coll. Jiang-tao Zhang & Xu-bo Wang; 2 ♀♀, Mianyang City, Jiangyou City, Taibai Park, *Lagerstroemia indica*, 29.vii.2014, coll. Jiang-tao Zhang & Xu-bo Wang; 5 ♀♀, Yibin City, Yibin University, *Cercis chinensis*, 20.vii.2014, coll. Jiang-tao Zhang & Xu-bo Wang; 1 ♀, Neijiang City, Haozikou Road, *Ficus virens*, 19.vii.2014, coll. Jiang-tao Zhang & Xu-bo Wang; 2 ♀♀, Nanchong City, Yingshan Country, *Ficus concinna*, 8.x.2003, coll. Ke Zhang. Yunnan: 2 ♀♀, Kunming City, Shilin Yizu Autonomous County, Changhu Town, *Bidens pilosa*, 11.vii.2019, coll. Jiang-tao Zhang, Kun Huang & Yan Li. Zhejiang: 1 ♀, Lin'an City, Shunxi Town, *Citrus reticulata*, 10.viii.2008, coll. Jin Liu.

Host plants. Asteraceae: *Bidens pilosa*; Casuarinaceae: *Allocasuarina verticillata* (= *Casuarina stricta*); Dioscoreaceae: *Dioscorea* sp.; Euphorbiaceae: *Macaranga tanarius*, *Melanolepis multiglandulosa*; Fabaceae: *Cercis chinensis*, *Pueraria lobata*; Lythraceae: *Lagerstroemia indica*; Malvaceae: *Sterculia foetida*; Moraceae: *Artocarpus nitidus* (= *A. lanceolata*), *Broussonetia papyrifera*, *Ficus concinna*, *F. virens*; Myrtaceae: *Psidium guajava*; Rubiaceae: *Coffea arabica*; Rutaceae: *Citrus reticulata*; Urticaceae: *Girardinia diversifolia* (Tsai 2011; Wang et al. 2018).

Distribution. Fujian, Hubei, Sichuan, Taiwan, Yunnan, Zhejiang (Tsai 2011).

Remarks. Good descriptions and illustrations of the adult female can be found in Tu et al. (1988), Cox (1989), and Williams (2004).

Planococcus lilacinus (Cockerell, 1905)

Pseudococcus lilacinus Cockerell, 1905: 128.

Pseudococcus tayabanus Cockerell, 1905: 129.

Dactylopius coffeae Newstead, 1908: 37.

Dactylopius crotonis Green, 1911: 35.

Pseudococcus deceptor Betrem, 1937: 54.

Tylococcus mauritiensis Mamet, 1939: 579.

Planococcus lilacinus: Ferris 1950: 164.

Planococcus indicus Avasthi & Shafee, 1987: 38.

Material examined. Fujian: 2 ♀♀, Zhangzhou City, Zhao'an County, Jinxing Village, *Annona squamosa*, 5.iv.2017, coll. De-yi Yu, Jin-ai Yao & Peng Huang. Guangdong: 5 ♀♀, Heyuan City, Huada Street, *Ficus concinna*, 10.v.2015, coll. Qing-song Zhou & Xu-bo Wang; 2 ♀♀, Heyuan City, Yanjiang Street, *Ficus elastica*, 10.v.2015, coll. Qing-song Zhou & Xu-bo Wang; 4 ♀♀, Zhongshan City, Yi Ling Road, *Ficus concinna*, 7.v.2015, coll. Qing-song Zhou & Xu-bo Wang; 5 ♀♀, Guangzhou City, *Bauhinia purpurea*, 6.xii.2011, coll. Shao-bin Huang. Guangxi: 2 ♀♀, Chongzuo City, Huashan Road, *Lagerstroemia speciosa*, 1.v.2017, coll. Jiang-tao Zhang & Ming Zhao; 2 ♀♀, Chongzuo City, Pingxiang City, Pingshan Road, *Ficus concinna*, 1.v.2017, Jiang-tao Zhang & Ming Zhao; 1 ♀, Chongzuo City, Jiangzhou District, *Bischofia javanica*, 29.iv.2017, Jiang-tao Zhang & Ming Zhao; 2 ♀♀, Fangchenggang City, Bailu Park, *Lagerstroemia speciosa*, 26.iv.2017, Jiang-tao Zhang & Ming Zhao; 5 ♀♀, Hechi City, Chuanshan Town,

Citrus sp., 26.vii.2015, coll. Jiang-tao Zhang; 6 ♀♀, Beihai City, Dongqu Park, *Broussonetia papyrifera*, 5.v.2015, coll. Qing-song Zhou & Xu-bo Wang. Hainan: 13 ♀♀, Wanning City, Xinglong Tropical Botanical Garden, *Coffea* sp., 2.v.2009, coll. Guo-qi Zhou. Yunnan: 2 ♀♀, Lancang Lahu Autonomous County, Meng Long Street, *Cassia fistula*, 13.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Mengla County, host plant unknown, 13.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Xishuangbanna Tropical Botanical Garden, *Capparis masaikai*, 21.x.2013, coll. Jun Deng & Xu-bo Wang. Zhejiang: 8 ♀♀, Wenzhou City, Daxi Town, *Ficus erecta*, 3.vii.2009, coll. Xiao-xiao Wang.

Host plants. Annonaceae: *Annona reticulata*, *A. squamosa*; Arecaceae: *Roxburghia oleracea*; Cannabaceae: *Celtis sinensis*; Capparaceae: *Capparis masaikai*; Combretaceae: *Terminalia* sp.; Ericaceae: *Rhododendron* sp.; Euphorbiaceae: *Alchornea moluccana*, *Codiaeum variegatum*, *Croton* sp., *Macaranga* sp., *M. sinensis*, *Mallotus japonicus*, *Melanolepis multiglandulosa*; Fabaceae: *Acacia confusa*, *Bauhinia blakeana*, *B. purpurea*, *B. variegata*, *Cassia fistula*, *Dalbergia odorifera*, *Erythrina* sp., *Tamarindus indica*; Lamiaceae: *Callicarpa formosana*, *Tectona grandis*; Lythraceae: *Lagerstroemia indica*, *L. speciosa*; Malvaceae: *Bombax malabarica*, *Heritiera littoralis*, *Sterculia foetida*; Moraceae: *Artocarpus altilis* (= *A. incisus*), *A. heterophyllus*, *A. xanthocarpus*, *Broussonetia papyrifera*, *Ficus concinna*, *F. elastica*, *F. erecta*, *F. microcarpa*; Myricaceae: *Myrica rubra*; Myrtaceae: *Psidium guajava*, *Syzygium jambos*, *S. samarangense*; Phyllanthaceae: *Bischofia javanica*, *Bridelia* sp.; Rubiaceae: *Coffea* sp., *C. arabica*, *Gardenia jasminoides*; Rutaceae: *Citrus* sp.; Solanaceae: *Solanum violaceum* (= *S. indicum*); Tamaricaceae: *Tamarix chinensis* (Tang 1992; Tsai 2011; Ma et al. 2019; Zhang et al. 2019).

Distribution. Fujian, Guangdong, Guangxi, Hainan, Hongkong, Macao, Taiwan, Yunnan, Zhejiang (Tsai 2011; Gu et al. 2015).

Remarks. Good descriptions and illustrations of the adult female can be found in Tu et al. (1988), Cox (1989), and Williams (2004).

Planococcus litchi Cox, 1989

Planococcus litchi Cox, 1989: 48.

Material examined. Beijing: 12 ♀♀, Institute of Zoology, Chinese Academy of Sciences (indoor), *Radermachera sinica*, 5.v.2014, coll. Xu-bo Wang; 4 ♀♀, Beijing Botanical Garden (greenhouse), *Eriobotrya japonica*, 15.viii.2000, coll. San-an Wu. Guangxi: 1 ♀, Baise City, Multinational Autonomous County of Longlin, Huancheng Road, *Bauhinia blakeana*, 5.v.2017, coll. Jiang-tao Zhang & Ming Zhao; 1 ♀, Baise City, Multinational Autonomous County of Longlin, Huancheng Road, *Dimocarpus longan*, 5.v.2017, coll. Jiang-tao Zhang & Ming Zhao; 2 ♀♀, Baise City, Jingxi City, Zhongshan Park, *Dimocarpus longan*, 3.v.2017, coll. Jiang-tao Zhang & Ming Zhao; 2 ♀♀, Fangchenggang City, Fangcheng District, Heti Road, *Dimocarpus longan*, 28.iv.2017, coll. Jiang-tao Zhang & Ming Zhao. Yunnan: 1 ♀, Jingdong Yi Autonomous County, *Ficus concinna*, 7.x.2012, coll. Fu-zhong Wu.

Host plants. Bignoniaceae: *Radermachera sinica*; Fabaceae: *Bauhinia blakeana*; Moraceae: *Ficus concinna*; Rosaceae: *Eriobotrya japonica*; Sapindaceae: *Dimocarpus longan*, *Litchi chinensis* (Cox 1989; Martin and Lau 2011).

Distribution. Beijing, Guangxi, Hongkong, Yunnan (Martin and Lau 2011).

Remarks. Good descriptions and illustrations of the adult female can be found in Cox (1989) and Williams (2004).

***Planococcus minor* (Maskell, 1897)**

Dactylopius calceolariae var. *minor* Maskell, 1897: 322.

Planococcus pacificus Cox, 1981: 48.

Planococcus minor: Cox 1989: 52.

Planococcus psidii Cox, 1989: 62.

Material examined. Beijing: 4 ♀♀, Beijing world flower Wonderland Park (greenhouse), *Saxifraga* sp., 7.v.2009, coll. Shan-shan Wang & Wang-mu Deqing; 4 ♀♀, Beijing world flower Wonderland Park (greenhouse), *Fatsia japonica*, 7.v.2009, coll. Shan-shan Wang & Wang-mu Deqing; 4 ♀♀, Beijing Botanical Garden (greenhouse), *Codiaeum* sp., 28.ix.2008, coll. Shan-shan Wang & Wang-mu Deqing; 4 ♀♀, Beijing Forestry University (greenhouse), *Sanchezia speciosa*, 28.ix.2008, coll. Shan-shan Wang & Wang-mu Deqing. Guangdong: 4 ♀♀, Zhan-jiang City, *Mangifera indica*, 12.vi.2010, coll. Yan-biao He. Hainan: 1 ♀, Haikou City, *Mussaenda philippica*, 6.iv.2015, coll. Bo Cai. Shanghai: 7 ♀♀, *Jatropha curcas*, 9.xii.2010, coll. Ying Xu. Yunnan: 3 ♀♀, Ruili City, Jiegao, *Albizia julibrissin*, 23.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 1 ♀, Puer City, Lancang Lahu Autonomous County, *Canna coccinea*, 18.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Mengla County, Menglun town, *Codiaeum variegatum*, 15.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Mengla County, Menglun Town, *Costus comosus* var. *bakeri*, 15.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 1 ♀, Dai Autonomous Prefecture of Xishuangbanna, Mengla County, *Codiaeum variegatum*, 13.x.2016, coll. Xu-bo Wang & Yao-guang Qin; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Jinghong City, Mengbang Road, *Ixora chinensis*, 5.iv.2014, coll. Qing-tao Wu & Xiu-wei Liu; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Mengla County, Menglun Town, *Fagraea ceilanica*, 23.x.2013, coll. Fang Yu, Jun Deng, Qing-song Zhou & Xu-bo Wang; 3 ♀♀, Jinghong City, Yunnan Institute of Tropical Crops, *Coffea* sp., 24.ix.2012, coll. ?; 10 ♀♀, Jinghong City, Yunnan Institute of Tropical Crops, *Hevea brasiliensis*, 25.viii.2011, coll. Jin-qiang Wang; 4 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Xishuangbanna Tropical Botanical Garden, *Coffea* sp., 20.x.2008, coll. Kai-ping Ji; 6 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Xishuangbanna Tropical Botanical Garden, *Coffea arabica*, 6.iv.2008, coll. Jin Liu, San-an Wu & Shan-shan Wang; 4 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Xishuangbanna Tropical Botanical Garden, *Bidens pilosa*, 1.iv.2008, coll. Jin Liu, San-an Wu & Shan-shan Wang; 4 ♀♀, Jinghong City, *Hevea brasiliensis*, ix.2007, coll. Zhong-hua Wu; 2 ♀♀, Dai Autonomous Prefecture of Xishuangbanna, Xishuangbanna Tropical Botanical Garden, *Hevea brasiliensis*, 4.vii.2006, coll. Zhong-hua Wu; 6 ♀♀, Jinghong City, *Hevea brasiliensis*, 2006, coll. Zhong-hua Wu.

Host plants. Acanthaceae: *Andrographis paniculata*, *Dicliptera chinensis*, *Pachystachys lutea*, *Sanchezia speciosa*; Altingiaceae: *Liquidambar formosana*; Amaranthaceae: *Achyranthes aspera* var. *indica*, *Celosia argentea*;

Amaryllidaceae: *Hippeastrum equestre*; Anacardiaceae: *Mangifera indica*, *Pistacia chinensis*; Annonaceae: *Annona* sp., *A. squamosa*; Apocynaceae: *Adenium obesum*, *Asclepias fruticosa*, *Catharanthus roseus*, *Hoya carnosa*; Araceae: *Anthurium scherzerianum*, *Colocasia esculenta*, *Dieffenbachia picta*; Araliaceae: *Fatsia japonica*, *Polyscias fruticosa*, *Schefflera odorata*; Arecaceae: *Chrysalidocarpus lutescens*, *Hyophorbe amaricaulis*, *Livistona chinensis*; Asparagaceae: *Agave americana*, *Cordyline fruticosa*, *Dracaena surculosa*, *Hosta plantaginea*; Aspleniaceae: *Asplenium nidus*; Asteraceae: *Artemisia princeps*, *Bidens chilensis*, *B. pilosa*, *Chrysanthemum indicum*, *Crassocephalum crepidioides*, *Dahlia hybrida*, *Emilia sonchifolia*, *Gaillardia pulchella*, *Gynura bicolor*, *Lactuca sativa*, *Mikania cordata*, *Wedelia chinensis*; Balsaminaceae: *Impatiens walleriana*; Bignoniaceae: *Pyrostegia venusta*, *Tabebuia rosea*; Boraginaceae: *Cordia dichotoma*, *Ehretia microphylla*, *Messerschmidia argentea*; Cactaceae: *Mammillaria elongata*; Cannaceae: *Canna coccinea*, *C. indica*; Convolvulaceae: *Ipomoea aquatica*, *I. batatas*; Costaceae: *Costus comosus* var. *bakeri*; Cucurbitaceae: *Cucurbita moschata*, *Luffa cylindrica*; Cyperaceae: *Cyperus papyrus*; Dioscoreaceae: *Dioscorea* sp.; Dipterocarpaceae: *Parashorea chinensis*; Ebenaceae: *Diospyros kaki*, *D. philippensis*; Euphorbiaceae: *Acalypha hispida*, *Aleurites fordii*, *Codiaeum* sp., *C. variegatum*, *Euphorbia pulcherrima*, *Hevea brasiliensis*, *Jatropha curcas*, *Macaranga tanarius*, *Mallotus japonicus*, *Manihot esculenta*, *Melanolepis multiglandulosa*; Fabaceae: *Acacia confusa*, *Albizia julibrissin*, *Arachis* sp., *Bauhinia variegata*, *Calliandra surinamensis*, *Cassia alata*, *Centrosema pubescens*, *Erythrina variegata*, *Indigofera suffruticosa*, *Mimosa pudica*, *Phaseolus vulgaris*, *Pongamia pinnata*, *Pueraria lobata*, *Sophora tomentosa*, *Vigna unguiculata sesquipedalis*; Gentianaceae: *Fagraea ceilanica*; Lamiaceae: *Clerodendrum cyrtophyllum*, *C. paniculatum*, *C. trichotomum*, *Leonurus heterophyllus*, *Mentha canadensis*, *Perilla frutescens*, *Salvia plebeia*; Liliaceae: *Lilium* sp.; Lythraceae: *Punica granatum*, *Rotala* sp.; Magnoliaceae: *Michelia figo*; Malpighiaceae: *Malpighia glabra*; Malvaceae: *Abutilon indicum*, *Bombax malabarica*, *Corchorus capsularis*, *Hibiscus rosa-sinensis*, *H. sabdariffa*, *H. tiliaceus*; Moraceae: *Artocarpus heterophyllus*, *Broussonetia papyrifera*, *Ficus* sp., *F. benjamina*, *F. elastica*, *F. macrocarpa*, *F. superba* var. *japonica*, *Morus alba*, *M. australis*; Myrtaceae: *Melaleuca leucadendra*, *Psidium guajava*, *Syzygium samarangense*; Orchidaceae: *Cymbidium* sp., *Paphiopedilum* sp.; Oxalidaceae: *Oxalis corymbosa*; Pandanaceae: *Pandanus amaryllifolius*; Passifloraceae: *Passiflora edulis*; Phyllanthaceae: *Bischofia javanica*, *Breynia officinalis*, *Bridelia tomentosa*, *Phyllanthus amarus*; Pinaceae: *Pinus morrisonicola*; Piperaceae: *Piper nigrum*; Poaceae: *Misanthus floridulus*; Portulacaceae: *Portulaca pilosa*; Rhamnaceae: *Rhamnaceae*; Rosaceae: *Pyrus serotina*; Rubiaceae: *Coffea* sp., *C. arabica*, *Gardenia jasminoides*, *Ixora chinensis*, *Mussaenda philippica*; Rutaceae: *Clausena excavata*, *C. lansium*, *Citrus maxima*; Sapindaceae: *Dimocarpus longan* (= *Euphoria longana*); Saxifragaceae: *Saxifraga* sp.; Solanaceae: *Atropa belladonna*, *Brunfelsia uniflora*, *Datura metel*, *D. suaveolens*, *Solanum diphyllum*, *S. indicum*, *S. tuberosum*; Theaceae: *Camellia* sp.; Vitaceae: *Ampelopsis brevipedunculata*; Zingiberaceae: *Hedychium coronarium* (Martin and Lau 2011; Tsai 2011; Wang et al. 2016; Lin et al. 2019; Lu et al. 2021).

Distribution. Beijing, Guangdong, Guangxi, Hainan, Hongkong, Macao, Shanghai, Taiwan, Yunnan (Martin and Lau 2011; Tsai 2011; Lu et al. 2021).

Remarks. Good descriptions and illustrations of the adult female can be found in Tu et al. (1988), Cox (1989), and Williams (2004).

***Planococcus planococcoides* (Borchsenius, 1962)**

Pedronia planococcoides Borchsenius, 1962b: 235.

Planococcus planococcoides: Tang 1992: 377.

Nipaecoccus planococcoides: Danzig and Gavrilov-Zimin 2015: 482.

Material examined. Yunnan: 1 ♀, Jingdong Yi Autonomous County, *Schima wallichii*, 22.iv.1957, coll. N.S. Borchsenius.

Host plants. Pentaphylacaceae: *Eurya* sp.; Scrophulariaceae: *Buddleja officinalis*; Theaceae: *Schima wallichii* (Borchsenius 1962b).

Distribution. Yunnan.

Remarks. *Planococcus planococcoides* was transferred to *Nipaecoccus* as *N. planococcoides* by Danzig and Gavrilov-Zimin (2015), because it has conical setae on dorsum and additional cerarii along body midline. However, since it has an anal lobe bar present on each anal lobe, marginal cerarii numbering 18 pairs and claw without a denticle, here we follow Tang (1992) and place it under *Planococcus*. A good description and illustration of the adult female was given by Borchsenius (1962b).

***Planococcus vovae* (Nasonov, 1909)**

Coccus gossypifera Rondani, 1874: 43.

Pseudococcus (Dactylopius) vovae Nasonov, 1909: 484.

Pseudococcus inamabilis Hambleton, 1935: 112.

Pseudococcus junipericola Borchsenius, 1949: 116.

Planococcus vovae: Danzig 1980: 168.

Planococcus taigae Danzig, 1986: 19.

Material examined. Beijing: 3 ♀♀, Beijing Forestry University Campus, *Juniperus chinensis*, 9.vi.2022, coll. Yu-ang Li.

Host plants. Cupressaceae: *Juniperus chinensis*, *J. chinensis* 'Kaizuka', *J. chinensis* 'Kaizuka Procumbens', *J. formosana*, *J. sabina*, *Platycladus orientalis* (Yuan and Wei 2022; Wu et al. 2023).

Distribution. Beijing, Hebei (Yuan and Wei 2022; Wu et al. 2023).

Remarks. Good descriptions and illustrations of the adult female can be found in Cox (1989) and Williams and Granara de Willink (1992).

Notes. *Planococcus leppulus* (Wu, 2000), which possesses oral rim tubular ducts and cerarii numbering two or three pairs only present on posterior abdominal segments, is not included in this study.

Acknowledgements

The authors are grateful to Dr San-an Wu (Beijing Forestry University, Beijing, China) for reviewing earlier versions of this manuscript and providing many valuable suggestions and comments. We also thank Yu-ang Li (Beijing Forestry University, Beijing, China) for collecting and sending us specimens of *Planococcus vovae*.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Funding

The project was supported by the National Natural Science Foundation of China (32000328).

Author contributions

Data curation: JD. Writing - review and editing: JZ.

Author ORCIDs

Jiangtao Zhang  <https://orcid.org/0000-0002-0007-3918>

Jun Deng  <https://orcid.org/0000-0002-5390-6362>

Data availability

All of the data that support the findings of this study are available in the main text.

References

Bai XH, Wu GH, Shao WZ, Luo Q, Zhang HB (2020) Occurrence of *Planococcus citri* of Coffea in Yunnan Province. *Chinese Journal of Tropical Agriculture* 40(11): 90–94.

Borchsenius NS (1950) Mealybugs and Scale Insects of USSR (Coccoidea). Akademii Nauk SSSR. Zoological Institute, Moscow 32: 1–250.

Borchsenius NS (1962a) Notes on coccid fauna of China. 10. Descriptions of some new species of Pseudococcidae (Homoptera, Coccoidea). *Entomologicheskoe Obozrenie* 41: 583–595.

Borchsenius NS (1962b) Notes on the Coccoidea of China. 11. New genera and species of mealybugs fam. Pseudococcidae (Homoptera, Coccoidea). *Trudy Zoologicheskogo Instituta Akademii Nauk SSSR, Leningrad* 30: 221–244.

Cox JM (1989) The mealybug genus *Planococcus* (Homoptera: Pseudococcidae). *Bulletin British Museum (Natural History). Entomology* 58(1): 1–78.

Danzig EM, Gavrilov-Zimin IA (2010) Mealybugs of the genera *Planococcus* and *Crisicoccus* (Sternorrhyncha: Pseudococcidae) of Russia and adjacent countries. *Zoosystematica Rossica* 19(1): 39–49. <https://doi.org/10.31610/zsr/2010.19.1.39>

Danzig EM, Gavrilov-Zimin IA (2015) Palaearctic mealybugs (Homoptera: Coccoidea: Pseudococcidae), Part 2. Subfamily Pseudococcinae. Russian Academy of Sciences, Zoological Institute, St. Petersburg, 619 pp.

Ezzat YM, McConnell HS (1956) A classification of the mealybug tribe Planococcini (Pseudococcidae: Homoptera). *Bulletin of the Maryland Agriculture Experiment Station A-84*: 1–108.

Ferris GF (1921) Some Coccidae from Eastern Asia. *Bulletin of Entomological Research* 12(3): 211–220. <https://doi.org/10.1017/S0007485300040165>

Ferris GF (1950) Atlas of the Scale Insects of North America. (ser. 5). The Pseudococcidae (Part I). Stanford University Press Palo Alto, California, U.S.A., 278 pp.

García Morales M, Denno B, Miller DR, Miller GL, Ben-Dov Y, Hardy NB (2016) ScaleNet: a literature-based model of scale insect biology and systematics. <http://scalenet.info> [Accessed 1 July 2023]

Gu YJ, Liang F, Ma J (2015) Information analysis of scales on imported plant and plant products. *Journal of Biosafety* 24(3): 208–214.

Guo J, Lai XP, Gao JY, Li JX, Wang ZR, Yue JQ (2014) Occurrence and control of *Planococcus citri* of lemon garden in Dehong, Yunnan Province. *Plant Protection* 40(4): 157–160.

Hall TA (1999) BioEdit: A user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucleic Acids Symposium Series* 41: 95–98.

Hendricks H, Kosztarab M (1999) Revision of the Tribe Serrolecaniini (Homoptera: Pseudococcidae). de Gruyter, Berlin & New York, 213 pp. <https://doi.org/10.1515/9783110804140>

Kimura M (1980) A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* 16: 111–120. <https://doi.org/10.1007/BF01731581>

Kumar S, Stecher G, Li M, Knyaz C, Tamura K (2018) MEGA X: Molecular Evolutionary Genetics Analysis across Computing Platforms. *Molecular Biology and Evolution* 35(6): 1547–1549. <https://doi.org/10.1093/molbev/msy096>

Lin LH, Zheng LZ, Shi MZ, Li JY, Wang QY, Li L, Fu JW, Wu MX (2019) A molecular detection and identification method for papaya mealybug (*Paracoccus marginatus*), the first recorded invasive pest in Fujian province of China. *Journal of Fruit Science* 36(9): 1130–1139.

Lu NH, Cai B, Ma XH, Xu MF, Long Y, Meng R, Wu FZ, Lin W, Xu W, Yuan JJ, Yang ZY (2021) Beware of dispersal of a quarantine pest insect, *Planococcus minor* (Maskell, 1897), in Chinese Mainland. *Plant Quarantine* 35(1): 65–69.

Ma J, Liang F, Lin L, Liu HJ, Zhao JP, Hu HN (2019) Occurrence of *Planococcus lilacinus* (Cockerell) (Hemiptera: Pseudococcidae) in Guangzhou as a new invasive pest. *Journal of Environmental Entomology* 41(5): 1006–1010.

Martin JH, Lau CSK (2011) The Hemiptera-Sternorrhyncha (Insecta) of Hong Kong, China – An annotated inventory citing voucher specimens and published records. *Zootaxa* 2847(1): 1–122. <https://doi.org/10.11646/zootaxa.2847.1.1>

Pan YL, Huang K, Liu XP, Zhang JT (2021) *Planococcus japonicus* Cox (Hemiptera: Coccoidea: Pseudococcidae), a newly recorded mealybug in Yunnan, China. *Sichuan Journal of Zoology* 40(2): 203–207.

Tang FD (1992) The Pseudococcidae of China. Chinese Agricultural Science Technology Press, Beijing, China, 768 pp.

Tang FD, Li J (1988) Observations on the Coccoidea of Inner Mongolia in China. Inner Mongolia University Press, Inner Mongolia, 227 pp.

Tsai MY (2011) Mealybugs (Hemiptera: Pseudococcidae) of Taiwan. Doctoral Dissertation, Department of Entomology College of Bioresources and Agriculture National Taiwan University, Taiwan, China, 603 pp.

Tu WG, Wu WJ, Lee PP (1988) Planococcini of Taiwan (Homoptera: Pseudoccidae). *Annual of Taiwan Museum* 31: 71–101.

Wang XB, Zhang JT, Deng J, Zhou QS, Zhang YZ, Wu SA (2016) DNA barcoding of mealybugs (Hemiptera: Coccoidea: Pseudococcidae) from mainland China. *Annals of the Entomological Society of America* 109(3): 438–446. <https://doi.org/10.1093/aesa/saw009>

Wang YS, Zhou P, Tian H, Wan FH, Zhang GF (2018) First record of the invasive pest *Pseudococcus jackbeardsleyi* (Hemiptera: Pseudococcidae) on the Chinese mainland and its rapid identification based on species-specific polymerase chain reaction.

Journal of Economic Entomology 111(5): 2120–2128. <https://doi.org/10.1093/jee/toy223>

Williams DJ (2004) Mealybugs of southern Asia. The Natural History Museum, London. Southdene SDN. BHD., Kuala Lumpur, 896 pp.

Williams DJ, Granara de Willink MC (1992) Mealybugs of Central and South America. C.A.B. International, Wallingford, 635 pp.

Wu SA (2000) *Atrococcus* Goux and related genera of China (Hemiptera: Coccoidea: Pseudococcidae). *Acta Zootaxonomica Sinica* 25(2): 162–170.

Wu SA, Li YA, Xu H (2023) *Planococcus vovae* (Nassonov, 1909) is a new invasive pest to China (Hemiptera: Coccoidea: Pseudococcidae). *Chinese Journal of Applied Entomology* 60(2): 1–7. [2023-04-23]

Yuan FF, Wei JH (2022) First report and preliminary biology study of *Planococcus vovae* (Nassonov). *Plant Quarantine* 36(3): 50–53.

Zhang GF, Wang YS, Tian H, Xian XQ, Liu WX, Wan FH (2019) Dispersal of a quarantine pest insect, *Planococcus lilacinus* Cockerell (Hemiptera: Pseudococcidae), in Chinese Mainland. *Journal of Biosafety* 28(2): 121–126.

Zhang JT, Wu BW, Wu SA (2018) A review of the genus *Saccharicoccus* Ferris, 1950 (Hemiptera: Coccoidea: Pseudococcidae) in China, with description of a new species. *Zootaxa* 4375(1): 127–135. <https://doi.org/10.11646/zootaxa.4375.1.7>